High-spin states of neutron-rich odd-A isotopes ^{105,107,109}Tc

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Odd-even isotopes $^{105,\ 107,\ 109}$Tc are several protons below the 50-proton closed shell and midway in the 50-82 neutron shell, a region of nuclei characterized by shape coexistence and shape transitions. Using high statistics ^{252}Cf fission-gamma data at Gammasphere in 1995 and 2000, new level schemes of $^{105,\ 107,\ 109}$Tc are proposed. Spin/parity and configuration assignments are made based on determinations of multipolarities of low-lying transitions and level analogies to the previously reported levels [1]. Determinations of multipolarities of the low-lying transitions were made, for the first time, for ^{109}Tc and to confirm those reported for ^{105,107}Tc [2]. These determinations are based on the intensity balance of two cascading transitions in spectra, coincidence-gated from above, with intensity being corrected for internal conversion coefficients, and the ICC being compared to the theoretical values to derive the multipolarities. The yrast positive parity band built on $7/2^+[413]$ is extended to ~$33/2^+$ states in the isotopes. The yrast negative-parity band built on $5/2^-[303]$ is also extended in ^{105}Tc. The non-yrast negative-parity band built on $3/2^-[301]$ is observed for the first time in ^{105}Tc. The most important observations are the identifications of positive-parity bands built on the intruder $1/2^+[431]$ orbital originating from $\pi(g_{7/2}/d_{5/2})$ sub-shells in $^{105,\ 107}$Tc. This is the first time that this intruder band with large prolate deformations is observed in odd-Tc isotopes. It is of interest to note such an intriguing level sequence of the new $1/2^+[431]$ rotational band in ^{105}Tc that the $3/2^+$ level lies just below the $1/2^+$ bandhead, and the $7/2^+$ is below the $5/2^+$ level. This peculiar level sequence was also observed in isotone ^{107}Rh (N=62), which was explained by the decoupling parameter, a ~ -1. Band crossing of the yrast positive-parity band is observed for the first time in ^{105}Tc, and confirmed and extended in ^{107,109}Tc. In view of the decreasing crossing frequencies with increasing neutron number, almost the same crossing frequencies for Tc and Rh isotones, and no crossing observed in the odd-odd Rh isotopes [3], the band-crossings are most likely due to the $h_{11/2}$ neutrons.

1. J.K. Hwang et al., Phys. Rev. C**57**, 2250 (1997)
2. *Table of Isotopes*, 8th ed., (Wiley, New York, 1996)
3. Yixiao Luo et al., to be published